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May 18, 2001

Donna Wieting, Chief
Marine Mammal Conservation Division
Office of Protected Species
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD
20910-3226

Dear Ms. Wieting:

In response to the NMFS request for public comment and information on the U.S. Navy application requesting a Letter of Authorization (LOA) for the take of small numbers of marine mammals by harassment incident to Navy operations of the Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) Sonar, I submit the following:

The low frequency active component (LFA effectively at 240 dB re 1 uPa) of this sonar system has been employed in various formats by several organizations, and is known by several acronyms: TIAPS (Towed Integrated Active-Passive Sonar, LFA at 210 dB re 1 uPa, DREA, Canada) and TVDS (Towed Vertically Directive Source, LFA at 228 dB re 1 uPa, NATO), to name but two. **Both** of these systems (TIAPS, TVDS) have been implicated in **mass** strandings of beaked whales (Ziphiidae) on previous occasions, hence by definition their impact on marine mammals is **not** negligible. On the contrary, it is catastrophic for some species and populations.

The TIAPS/stranding event involved three live Blainville's beaked whales and it occurred in March 1998 at Rum Cay in the Bahamas. It has not been previously reported in the literature, but it is nonetheless factual and well documented. An American veterinarian at Rum Cay conducted necropsies on two of these whales within hours of their death, and reported his findings to the Bahamas National Trust by correspondence received May 18, 1998. The veterinarian, unaware of the prior TIAPS exercise, believed the whales had "cerebella dysfunction", and he observed "massive hemorrhage along with emphysematous gas throughout" (Balcomb and Claridge, in press; see also Crum and Mao, 1996 for possible explanation for this observation). This incident begged further investigation, as it was within the two week guideline of the "Follow-up Program" cited in the DREA Environmental Assessment to the Canadian government. Regrettably, however, it was not followed up, but that may have been due to everyone being busy preparing for the NATO panel concerning another mass stranding in Greece discussed later in this letter. I have photographs of the Rum Cay necropsies, additional testimony from the attending

veterinarian, and the cranium of one of these whales for forensic investigation if you consider this mass stranding germane. The rostrum shows evidence of a huge sharkbite (in vivo?) and the periotic shows evidence of hemorrhage.

Also with respect to TIAPS, we reported last year that a large balaenopterid (cf. *Balaenoptera physalus*) live stranded under mysterious circumstances on Eleuthera Island in the Bahamas on March 3, 2000. I subsequently have learned that this stranding was also following a TIAPS exercise in the area in February 2000. The balaenopterid stranding occurred four days after a self-imposed Canadian DREA follow-up program would have required an investigation for cause and effects vis a vis LFA, but it is otherwise inexplicable. We have an eye and tissue samples from this whale that may be of forensic importance.

The TVDS/stranding event occurred on May 12 and 13, 1996 in Kyparissiakos Gulf in Greece. In June 1998, a blue-ribbon NATO Bioacoustics Panel of experts concluded "An acoustics link can neither be clearly established nor eliminated as a direct or indirect cause for the May 1996 strandings" (D'Amico, 1998). Does NMFS have new evidence that now eliminates the possibility of an acoustic link in the Greek strandings, or has there been a bureaucratic dismissal of relevant information in this case? The acoustic and stranding evidence provided in the NATO report beg very serious review, and perhaps more research, in light of the recent strandings and acoustic links in the Bahamas. For example, the report provided clear evidence that Cuvier's beaked whales responded aversly to TVDS signals at distances of at least 20-25 kilometers, versus the 1 kilometer the U.S. Navy now proposes for marine mammal impact mitigation. That is a huge difference in distance that emphasizes why NMFS **must** provide an objective review and presentation of this entire issue on impacts of LFA. I do not consider that NMFS can legitimately dismiss the relevance of the strandings in Greece, particularly since a **second** LFA related stranding of 9 "mammals" was reported by the Hellenic Navy in October 1997 (D'Amico, 1998, Annex EE). The D'Amico document is in your office at the desk of Ken Hollingshead, so the facts are clearly available to you. That is where I first read that document, and it contains important background information that should be widely available to the public in this process.

With respect to SURTASS LFA, you describe the U.S. Navy system as a long-range, low frequency (between 100 and 500 Hertz) system that produces various waveforms that vary in frequency and duration, lasting as short as 6 seconds to as long as 100 seconds, but for some reason you did not mention that the source level (SL) for each of 18 projectors is approximately 215 dB re 1 uPa. You must recognize that this **single** source level is quite intense in itself, but in the VLA (Vertical Line Array) configuration with eighteen sources there is significant *effective* source level gain due to beam-forming in the vertical axis (see Johnson, 2001 pg 2-3; Johnson, 2000 pg B3; and D'Amico, 1988, Annex E). Within a steerable "beam" the effective source level would be approximately 240 dB re 1 uPa. I consider it a very serious omission of the NMFS proposed ruling to not mention how powerful this sonar system actually is, and I question the motivation for failing to do so. For all practical purposes, SURTASS LFA is many times more powerful than the source level of the

TVDS system used in Greece, or the TIAPS system used in the Bahamas. Yet, for all practical purposes, the frequencies and waveforms transmitted are quite similar (both CW and FM LFA signals of many seconds duration, repeated at intervals). The acoustic propagation to great distance for all of these systems is similar. As I mentioned in earlier paragraphs of this letter, such systems have already been implicated in numerous live strandings of cetaceans that subsequently died. Other cetaceans have fled from these sounds into situations that are not survivable for them without assistance, and they have done so well beyond the visible horizon of shipboard observers. In my estimation, the swath of injury and aversion to these sounds extends to at least the first caustic (convergence zone), which typically ranges from 33 to 66 kilometers away from the source, depending upon oceanographic conditions.

You seem to make a distinction between mid-frequency sonar and low frequency sonar as if there is some magical difference that would cause the former to be harmful and the latter relatively harmless to marine mammals. That is incorrect, all sound travels as pressure waves. It is also incorrect to pick hearing as the sensory modality for your only discussion concerning potential harm from these sounds. You paraphrase Richardson, et. al., (1995) in a way that is extremely misleading: 1) noise too weak to hear; 2) noise audible; 3) noise may elicit reaction; 4) repeated noise, diminished response; 5) noise masks; 6) noise potential to cause TTS/PTS. However, those authors actually listed four zones of noise influence, the fourth and most extreme of which reads: "The zone of hearing loss, discomfort, or injury is the area near the noise source where, for explosions and possibly some other strong sources, the received sound level is high enough to cause discomfort or tissue damage to auditory or other systems." In other words, in this notification process you have inappropriately attempted to lead the discussion toward auditory effects, whereas the authors you cite and objective reviewers clearly recognize that there are many non-auditory traumas attributable to sound received at high levels. These traumas can be, and often are, totally unrelated to hearing: lung damage and organ system hemorrhage in immersed laboratory animals at 170-184 dB of LFA (Dalecki, 1998), vestibular dysfunction at 160 dB of LFA (Jackson and Kopke, 1998), bubble growth in tissues from LFA (Crum and Mao, 1996; Lettvin, et. al., 1982), etc.

I personally observed hemorrhage in multiple organ systems and around the ears of the beaked whales impacted by high levels of sonar in the Bahamas on March 15, 2000. I noted that the whales stranded nearly simultaneously many miles away from the sonar sources, hence the impacts of these sounds do not simply represent a near-field problem. As a "team" member of a NMFS/Navy panel that was supposedly "investigating" this stranding, I reported all of this to you and others at NMFS last June in person. I have already explained (ltr to J.S. Johnson) that the NMFS/WHOI findings of hemorrhagic earbones and subarachnoid hemorrhage in beaked whales in the Bahamas sonar catastrophe were not strictly-speaking auditory traumas, they were non-auditory traumas caused by biophysical phenomena that must be investigated thoroughly before you consider adopting the proposed ruling on SURTASS LFA. It is my **hypothesis** that these traumas are exacerbated by resonance phenomena, but it is nonetheless a **fact** that the traumas occured and

that the whales died. It is not appropriate to dismiss facts that are relevant to this issue, as if it is only my theory that whales died. They did die.

The "taking" of marine mammals, particularly Ziphiids, by both MF and LF sonar has not been small and has not been negligible on the species or stock(s) affected. On multiple occasions, many Cuvier's beaked whales in several areas of the world have been killed by sonar, and on one occasion last March 15 the entire population inhabiting the northern Bahamas was either killed or displaced within a few hours by a single naval sonar "exercise". These beaked whales are relatively rare, and this is an astonishing observation: in the past year of extensive vessel surveys, we have not seen *any* of the 35 individuals that we have photo-identified over the previous nine years, nor have we seen *any* of the whales that were "rescued". Thank goodness our livelihood does not depend upon seeing these whales, although our research objectives do. There simply are none left to study, and I now regret ever having prior told NMFS and the Navy that this was a good area for beaked whale studies. It makes me wonder if the Navy didn't consider this area a good area for a definitive test of whether sonar can kill beaked whales.

In conclusion, the facts are that lethal "taking" and massive displacement of Cuvier's beaked whales by sonar was at ranges of 20 to 50 kilometers from the sound source in both Greece and the Bahamas, and such taking is simply not mitigible with current techniques, equipment and knowledge of the whales' distribution. I submit that Balaenopterids (minke, fin and humpback whales) and delphinids (offshore species) were also "taken" at great range in the Bahamas and elsewhere in Naval exercises. The distance from the source ship(s) and the "taking" is approximately equivalent to the distance to the first caustic, or convergence zone, of the sonar, and it is at this distance that the RL should be mitigated so as not to exceed 120 dB, or whatever is the flight response distance demonstrated for each and every marine mammal species inhabiting the area.

I recommend that NMFS advise the Navy to adopt the no action alternative to further development and deployment of the SURTASS LFA system.

Sincerely,

Kenneth C. Balcomb, III

Whale Research Biologist